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(LYMPH NODES physiol)

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The tuberculostatic therapy opens a new era in the treatment of bone and joint tb. We can influence the progress of the tb process and when this occurs at an early stage the function of the joint can be preserved. The rehabilitation based on the programme of Babič was used. In the first stage of the disease (evolution) the patient is immobilized in bed. In the reparative stage active movements in bed are started followed by walking with crutches. In advanced regeneration the patients start to walk without aids, swimming is allowed and light active and ball games. The rehabilitation is combined with specific therapy.

Vojtek - Sumperk (XV, 7, 9*)

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(PNEUMOMEDIASTINUM) (ESOPHAGUS --CANCER)
(STOMACH--CANCER) (DIAGNOSIS RADIOSCOPIC)

L 24483-66 EWT(m)/EWP(j) LJP(c) RM

ACC NR: AP6006988 SOURCE CODE: UR/0190/66/008/002/0357/0360

AUTHORS: Ginzburg, L. V.; Shvarts, A. G.; Shershnev, V. A.; Neratova, T. N.

ORG: Moscow Institute of Fine Chemicals Technology im. M. V. Lomonosov (Moskovskiy institut tonkoy khimicheskoy tekhnologii)

TITLE: Vulcanization of rubber with products of hydrohalogenation of phenol dimethylol derivatives

SOURCE: Vysokomolekulyarnyye soyedineniya, v. 8, no. 2, 1966, 357-360

TOPIC TAGS: vulcanization, rubber, chemical reaction kinetics, tracer study

ABSTRACT: Vulcanization of rubber with 2, 6-dibromodimethyl-4-tert-butylphenol (I) and 2, 6-dichlorodimethyl-4-tert-butylphenol (II) was investigated. It was hoped that the reactivity of I and II would prove high enough to make the use of accelerators unnecessary. Compounds I (m.p. 71C) and II (m.p. 68C) were synthesized by passing the corresponding hydrogen halide through a solution of 2,6-dimethylol-4-tert-butylphenol in glacial acetic acid. The kinetics of vulcanization was investigated by using labeling techniques. It was established that the process of

vulcanization occurs in two stages: 1) addition, and 2) formation of cross-links.

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ACC NR: AP6006988 0

Under the temperature conditions required, the vulcanization is accompanied by evolution of hydrogen halide (60% at 140C) which serves as a "built-in" accelerator of vulcanization. Mechanistic explanations of the reactions are offered. Orig. art. has: 5 figures, 1 equation, and 1 formula.

SUB CODE: 07, 11/ SUBM DATE: 24Mar65/ ORIG REF: 005/ OTH REF: 001

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(ANTIBIOTICS, eff.
on exper. meningeal tuberc., role of CNS funct. & eff. of phenobarbital-induced sleep & of amphetamine)
(SLEEP, eff.
phenobarbital-induced sleep, on meningeal tuberc. during antibiotic ther., in dogs)
(AMPHETAMINE, eff.
on meningeal tuberc. during antibiotic ther., in dogs)
(CENTRAL NERVOUS SYSTEM, in various dis.
exper. meningeal tuberc., eff. of phenobarbital-induced sleep & amphetamine on response to antibiotic ther., in dogs)

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pathogen. in latent form of canine meningeal tuberc.)

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Meretin, M.

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Comparative toxicity of certain lithium compounds in animal experiments. Farm. i toks. 21 no.4:93-95 Jl-Ag '58 (MIRA 11:11)
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comparative of various cpds in animals (Rus))

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lithium chloride pois. in animals, eff. on blood count (Rus))
(BLOOD CELLS,
count. eff. of exper. lithium chloride pois. (Rus))

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41 no.5:69-73 My '61.
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NERETINA, Anna Yakovlevna

[Formation of minerals and structures during the electrochemical reinforcement of unstable rocks] Formirovanie mineralov i struktur pri elektrokhimicheskom zakreplenii neustoichivykh gornykh porod. Moskva, Nauka, 1964. 76 p.
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[Using electrochemical methods for stabilizing unstable rocks] Elektrokhimicheskii metod zakrepleniia neustoichivykh gornykh porod. Moskva, Gos.nauchno-tekhn.izd-vo neft. i gorno-toplivnoi lit-ry, 1959. 77 p. (MIRA 12:5)
(Soil stabilization)

NERETINA, A. Ya.

14(5) PHASE I BOOK EXPLOITATION SOV/2641

Titkov, Nikolay Iosafovich, Aleksandr Sergeyevich Korzhuyev, Vladimir Georgiyevich Smolyaninov, Vladimir Aleksandrovich Nikishin, and Anna Yakovlevna Neretina

Elektrokhimicheskiy metod zakrepleniya neustoychivykh gornykh porod (Electrochemical Method for Consolidation of Unstable Rocks) Moscow, Gostoptekhizdat, 1959. 77 p. (Series: Novaya tekhnika neftyanoy promyshlennosti) Errata slip inserted. 2,000 copies printed.

Ed.: M.A. Geyman; Exec. Ed.: N.D. Dubrovina; Tech. Ed.: A.S. Polosina.

PURPOSE: This book is intended for engineers and technicians of the petroleum and mining industry, for constructors of railroads, highways, and hydraulic systems, and for scientists concerned with the problem of consolidating unstable soft rock formation.

COVERAGE: The book presents scientific principles of the electrochemical method applied in order to consolidate unstable soft rocks, and reviews results of laboratory and field tests conducted to appraise the practicability of

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Electro-chemical (Cont.)

this method. Results of tests made by the Petroleum Institute of the Academy of Sciences, USSR, indicate that this promising method may find a wide application in petroleum and natural gas production. It may result in the elimination of metallic casing pipes inasmuch as the use of direct current combined with the application of special solutions (electrolytes) can consolidate argillaceous and other rocks to the extent which will make the further reinforcement of borehole walls unnecessary. It has been ascertained that electrochemical consolidation of walls of wells drilled in clayey formations can be applied to wells in process of drilling as well as to wells already in production. The book contains a detailed analysis of tests made under different geological conditions in the Tatarskaya ASSR, illustrates results of these tests in numerous tables, shows the composition of solutions used, and describes the laboratory and field equipment with the aid of which the experiments were carried out. The method under review can be successfully used in coal and ore mining, and in the construction of ventilation shafts, of hydraulic and irrigation systems, etc. The authors thank Academician P.A. Rebinder, Senior Scientific Assistant N.N. Serb-Serbina, and Professor V.P. Petrov for their valuable comments. They also thank members of the Petroleum Institute of the Academy

of Sciences V.Ye. Bykov, Ye.G. Getts, S.N. Yelovikova, N.I. Maksimova, and A.S. Chekhlov. There are 5 references: 3 Soviet and 2 German.

TABLE OF CONTENTS:

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12-2-59

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Formation of the structure of hardened cement at rising temperatures. Neft. khoz. 40 no.11:25-30 N '62. (MIRA 16:7)

(Oil well cementing)

TITKOV, N.I.; DON, N.S.; NERETINA, A.Ya.

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USSR/Anodes
Heat

Mar 1946

"Evolution of Heat on the Anode of a Gas Discharge," N. A. Neretina, 4 pp All-Union Electrotech. Inst, Moscow

"Zhur Tekh Fiz" Vol XVI, No 3

Schematic diagrams of subject apparatus. Table giving the relation among pressure of gas in tube, temperature of anode, calories of heat released, potential between electrodes, etc.

12T89

NEKRETINA, N. A. Cand Tech Sci

Dissertation: "Anodic Region of Mercury Discharge."

21/2/50

All-Union Order of Lenin Electric Engineering Inst imeni V. I. Lenin

SO Vecheryaya Moskva
Sum 71

NERETINA, N. A.

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Dissertation for Candidate Degree

FD-3133

USSR/Physics - Discharge gas density

NERETINA, N.A.

Card 1/2 Pub. 153 - 8/19

Author : Klyarfel'd, B. N.; Timofeyev, A. A.; Neretina, N. A.; Guseva, L. G.

Title : Characteristics of probes at positive potentials and measurement of density of gas in discharges

Periodical : Zhur. tekh. fiz., 25, No 9 (September), 1955, 1581-1596

Abstract : The authors review the discharge phenomena near a probe that has a positive potential relative to the plasma. Utilization of certain properties of the volt-ampere characteristics of such a probe permit them to measure the variation of the gas density under the action of discharge fed by a direct or alternating current. They find that with increasing positive potential on the probe relative to gas-discharge plasma the volt-ampere characteristics of the probe indicate the existence of two regimes: a) regime of probe corresponding to non-independent form of discharge, and b) regime of anode corresponding to independent discharge able to exist even when the main discharge is switched off; the transition between the two regimes of probe operation is effected in most cases by a jump suggestive of the phenomenon of rupture. Difference in potentials between plasma and positively charged probe at which rupture of layer near probe occurs increases with decrease in the density of the gas and with increase in density of discharge current; these properties can be used to measure the gas density in the limits of intense discharge, and suggests a convenient method for measuring

densities in various gases and vapors. The region of measurements of gas densities can be regulated by changes in the radius of the cylindrical probe used, since the rupture strength of the layer increases with decrease in radius; this is the result of decrease in the thickness of that part of the layer near the probe in which the electrons produce intense ionization of the gas. Comparatively small increase in probe current in the positive branch of the characteristics of a plane probe is mainly determined by increase in plasma of ions generated in the layer; recharging of positive ions amplifies this effect by several times. Transition of the probe to the anode regime is accompanied by formation around the probe of a new intense plasma of small size separated from the remaining plasma by a potential drop. Ordinarily this regime is unstable and the probe passes continuously from the anode regime to the probe regime and reversely, thus forming deep oscillations in the voltage strength with frequency of 10^4 to 10^6 cycles. The proposed mechanism governing these oscillations consists in the periodic accumulation of positive ions around the probe with formation of new small plasma and in the disintegration of this plasma after the voltage at the probe drops to a small value. For the study of dynamic variation of gas density in discharges the authors developed an impulse probe method permitting measurement of instantaneous values of gas density in various phases of discharge burning on alternating or periodic current. Nineteen references: e.g. B. Klyarfel'd, L. Pervova, ibid., 15, 640 1945; V. Granovskiy, T. Suyetin, ibid., 16, 1023, 1946 and 17, 291, 1947; etc.

Submitted : March 22, 1955

NERETINA, N. A.

"Current Distribution on the Plate Surface of Mercury Rectifiers,"
p. 218 in book Research in the Field of Electric Discharge in Gases,
Moscow, Gosenergoizdat, 1958, 239pp. (Trudy Vsesoyuznyy elektrotekhnicheskiy inst.)

NERETINA, N.A.

AUTHOR: Sergeyev, A. S., Docent

105-58-4-27/37

TITLE: Dissertations (Dissertatsii)

PERIODICAL: Elektrichestvo, 1958, Nr 4, pp. 96-97 (USSR)

ABSTRACT: For the Degree of Candidate of Technical Sciences, 1946-1954.

1. At the All-Union Institute for Electrical Engineering imeni Lenin. (Vsesoyuznyy elektrotekhnicheskiy institut im. Lenina).

N. A. Neretina, on February 21, 1950: "Anode Range of Mercury Discharge". Official opponents were: Doctor of Physico-Mathematical Sciences Professor M. A. Kaptsov and Doctor of Physico-Mathematical Sciences Professor V. L. Granovskiy.

A. V. Rubchinskiy, on June 27, 1950: "Reconstitution of the Break-Down Resistance After Spark Discharge". Official opponents were: Doctor of Technical Sciences Professor L. I. Sirotinskiy, Doctor of Physico-Mathematical Sciences Professor S. P. Zhebrovskiy and Doctor of Technical Sciences Professor G. V. Spivak.

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Dissertations

105-58-[illegible]-27/37

M. I. Sysoyev, on June 17, 1952: "Break Down of Compressed Air in an Heterogenous Electric Field". Official opponents were: Doctor of Technical Sciences Professor B. M. Klyarfel'd, Doctor of Physico-Mathematical Sciences Docent V. A. Mikhaylov and Candidate of Technical Sciences Docent P. V. Borisoglebskiy.

G. A. Lebedev, on April 28, 1953: "Wet Discharge Voltages in Insulators". Official opponents were: Doctor of Technical Sciences Professor L. I. Sirotinskiy and Doctor of Technical Sciences Professor I. A. Syromyatnikov.

V. V. Afanas'yev, on May 11, 1954: "Construction of High-Voltage A. C. Disconnection Apparatus". Official opponents were: Doctor of Technical Sciences M. A. Babikov and Doctor of Technical Sciences Ye. M. Tseyrov.

2. At the Institute for Power Engineering imeni Krzhizhanovskiy AS USSR (Energeticheskiy institut im. Krzhizhanovskogo AN SSSR).

V. S. Lugovoy, on February 23, 1950: "Resonance Circuits With Loss Compensation for Checking the Resistivity of an Arc-Eliminating Apparatus". Official opponents were: Doctor of Technical Sciences Professor I. S. Stekol'nikov and Candidate of Technical Sciences Yu. G. Tolstov.

Card 2/4

Yu. V. Skobel'tsyn, on October 26, 1950: "Rural Electric Power Stations in the Forest Zone of the European Part of the USSR as Shown by the Example of the Mariyc SSR". Official opponents were: Doctor of Technical Sciences A. G. Zakharin and Candidate of Technical Sciences N. A. Karaulov.

G. F. Kozlovskiy, on May 11, 1953: "Experimental and Theoretical Investigation of Ferromagnetic Gap-Filling Substances in Electromagnetic Mechanisms". Official opponents were: Doctor of Technical Sciences Professor A. N. Larionov and Doctor of Technical Sciences Professor Yu. G. Tolstov.

M. A. Bagirov, on September 17, 1953: "Experimental Investigation of Long Sparks". Official opponents were: Doctor of Physico-Mathematical Sciences Professor N. A. Kaptsov and Candidate of Technical Sciences S. T. Bondarenko.

O. V. Mamontov, on September 17, 1953: "Calculation of the Transient Processes in Complicated Linear Circuits by Means of the Fourier Integral". Official opponents were: Doctor of Technical Sciences Professor G. I. Atabekov and Candidate of Technical Sciences V. M. Matyukhin.

Dissertations

105-58-4-27/37

Sh. I. Lutidze, on April 29, 1954: "Investigation of the Electronic Excitation of Synchro-Generators According to the Scheme With Independent Excitation Using Buffer Valves". Official opponents were: Corresponding Member of the AS USSR A. M. Larionov and Candidate of Technical Sciences A. M. Utevskiy.

AVAILABLE: Library of Congress

1. Electrical engineering-Reports

Card 4/4

NERETINA, N.A.

57-2-18/32

AUTHORS: Klyarfel'd, B. N., Neretina, N. A.

TITLE: The Anode Region in Gas Discharge at Low Pressures (Anodnaya oblast' v gazovom razryade pri nizkikh davleniyakh)
I. The Influence of the Anode Mold on the Sign and the Quantity of the Anode Fall (I. Vliyaniye formy anoda na znak i velichinu anodnogo padeniya)

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 1958, Vol. 28, Nr 2, pp.296-315 (USSR)

ABSTRACT: The phenomena at the anode in mercury discharge were here investigated for the 3 most characteristic cases: a hollow cylindrical anode, a semispherical anode with a diameter equal to 0,3 of the column diameter and a flat anode filling the entire column cross section. The investigations were performed at pressures of below 0,1 mm torr. (i.e. in the absence of a marked discharge concentration in the column or at the anode) and in the range of discharge-currents from 0,03-10 A, at a column diameter of 32 mm. The hollow and semi-spherical anode in all cases possess a negative and positive sign of

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The Anode Region in Gas Discharge at Low Pressures. I. The Influence of the Anode Mold on the Sign and the Quantity of the Anode Fall

the anode fall respectively. A heating of these anodes to 700-800°C does not cause a change of the quantity or the sign of the anode fall. Summarizing the authors state: 1) The sign of the anode fall is determined by the conditions for a generation and for the disappearance of the positive ions in the region of the anode. In those cases where these conditions favor the formation of the concentration of positive ions which are sufficient for the neutralization of the space charge of the electrons transferring the discharge-current to the anode, no anode fall occurs or it has a small negative value. In the case of a deficiency of positive ions a positive anode fall forms. 2) An anode of small dimensions near which the positive ions are dispersed under the simultaneous influence of the diffusion and the electric field is in all cases characterized by the positive anode fall of considerable amount and by the development of supersonic frequency--variations in the anode region. The hollow anode which is filled with positive anodes of long life is characterized by a negative anode fall up to mercury-vapor-pressures of 0,1 mm (higher up the contraction of the discharge begins). 3) The

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flat front-anode which fills the entire cross section of the discharge is characterized by a negative anode fall at pressures up to 0,01 mm and by a positive anode fall at $p > 0{,}01$ mm. In the latter case the anode fall only remains constant in discharge-currents of below 1 A (diameter of the tube = = 32 mm). The reason for the change of sign of the anode fall on a rise of pressure lies in the deterioration of the conditions for the retention of the high concentration of positive ions. In a cold state the flat anode mainly has a negative anode fall. 4) The investigation of the space in front of the flat front-anode by means of probes showed that the selection of the ionic currents directed toward the anode through the anode creates a zone with diminished concentration of charged particles and diminished brightness. In the presence of a negative anode fall in the section of the positive column lying against the anode a flat concentration-maximum of the charged particles occurs on a length of 4 - 5 column diameter. In a positive anode fall the disturbance of the homogeneity of the column begins in a distance from the anode with an order of

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magnitude beginning from one column-diameter . 5) The analysis of the phenomena in the negative anode fall shows that the quantity of the anode fall increases with the increase in the electron-temperature and with the increase in the relation of the density of the random ionic current to the density of the discharge-current. Both conditions are satisfied in the plasma of a discharge between an annealed thread emitting electrons and a coaxial cylindrical anode. In a number of inert gases it was found that in a similar kind of discharge under pressure of the order of magnitude 10^{-4} - 10^{-3} mm the electron-temperature-values attain 150-200 000°K, whereas the relation of the densities of the disordered ionic current and the discharge-current is equal to several dozens. The negative anode falls measured according to the method of probes on that occasion attained 40-50 V. There are 14 figures, 2 tables, and 20 references, 11 of which are Slavic.

ASSOCIATION: All-Union Institute of Electro-Engineering imeni V. I. Lenin, Moscow (Vsesoyuznyy elektrotekhnicheskiy institut im. V. I. Lenina, Moskva)

SUBMITTED: May 20, 1957
AVAILABLE: Library of Congress
Card 4/4

1. Anodes-Phenomena 2. Gases-Discharge 3. Mercury

66395
SOV/58-59-10-23102

24,2120

Translation from: Referativnyy Zhurnal, Fizika, 1959, Nr 10, pp 187 - 188 (USSR)

AUTHOR: Neretina, N.A.

TITLE: Current Distribution on Mercury-Valve Anode Surfaces

PERIODICAL: Tr. Vses. elektrotekhn. in-ta, 1958, Nr 63, pp 218 - 239

ABSTRACT: The distribution of current on the anode surfaces of mercury rectifiers was measured at various currents and under various pressures. It was found that the least uniformly loaded anode was a cylindrical one (lateral and face working surfaces). Current is more uniformly distributed on a plane anode. The best results were obtained in the case of a hollow cylindrical anode with an internal lateral working surface. In all cases the current distribution on the anode surface depends on the grid - anode distance and the grid design. The author also studied the high-frequency oscillations caused by a variation in current density on individual sections of the anode. The oscillation frequency amounts to 10^3 to 10^4 c. The oscillation amplitude decreases with an increase in grid - anode distance and pressure. The bibliography contains 31 titles.

N.G. Kashnikov

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66695

24.2100 SOV/109-4-8-15/35

AUTHORS: Neretina, N.A. and Klyarfel'd, B.N.

TITLE: Formation of Light Spots on the Anode

PERIODICAL: Radiotekhnika i elektronika, 1959, Vol 4, Nr 8, pp 1301 - 1305 (USSR)

ABSTRACT: When the positive anode fall U_a and the gas pressure p reach certain values, it is found that bright light spots are formed on the uniform layer of the anode glow. It has been found that in mercury-vapour discharges, these values are U_a = 7-8 V, p = 0.003 mm Hg. When the spot is formed, the anode voltage fall changes discontinuously and is reduced to 2 - 4 V. When the pressure is further increased, the spot is reduced and a number of new spots appear; these form regular patterns on the surface of the anode. In spite of extensive experimental data on the anode spots, their nature is not as yet understood. The authors investigated the properties of the plasma inside the individual anode spots. This was done by employing a small probe which could be introduced into a spot through

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Formation of Light Spots on the Anode

a narrow slot cut in the anode. Figure 1 shows the change U_0 of the voltage fall on a discharge and the change of the positive potential fall ΔU of the anode as a function of the current in the anode region. The figure shows that the formation of the spot leads to the breakdown of the layer of the negative space charge in the vicinity of a given section of the anode. The values of the discharge current and the gas pressure at which the spots appeared were investigated for a hydrogen discharge produced on a flat anode. The diameter of the experimental tube was 50 mm. The results of the measurements are shown in Figure 2. The numbers by the various curves denote the number of spots. It was found that the spots appear only within a definite region of pressures. At comparatively high pressures, the spots become blurred and finally disappear. The pressure at which the spots exist are as follows: 0.003 to 1 mm for mercury; 0.15 to 5 mm for hydrogen and a few mm to about 200 mm for neon and helium. The mechanism of the spot formation can be explained as

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Formation of Light Spots on the Anode

follows. Under the conditions leading to the increase of the anode fall and at a sufficiently high pressure, the density of the ion generation is so high that a new plasma in the form of a fine film is formed near the surface of the anode. The existence of the plasma film is unstable. Probe measurements have shown that the potential inside the spots is a few volts higher than the anode potential. By employing a cathode oscillograph, it was found that intense oscillations with ultrasonic frequencies were produced in the double layer situated between the positive column and the spot. On the other hand, the oscillations in the ionic layer between the spot and the anode surface are comparatively weak. When the anode dimensions are small and the gas pressures are low, the anode is fully enveloped by the spot which then has the form of a glowing sphere. In this case, oscillations having a comparatively high amplitude and a frequency in the ultrasonic range are obtained at the anode. An approximate potential distribution in the vicinity of the anode during the various stages of the oscillation is

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indicated in Figure 4.
There are 4 figures and 10 references, 2 of which are German, 2 English and 6 Soviet.

SUBMITTED: March 5, 1959

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NERETINA, N.A.

66702

24,2120 SOV/109-4-8-22/35

AUTHORS: Granovskiy, V.L., Luk'yanov, S.Yu., Spivak, G.V. and Sirotenko, I.G.

TITLE: Report on the Second All-Union Conference on Gas Electronics

PERIODICAL: Radiotekhnika i elektronika, 1959, Vol 4, Nr 8, pp 1339 - 1358 (USSR)

ABSTRACT: The conference was organised by the Ac.Sc.USSR, the Ministry of Higher Education and Moscow State University.

A.A. Timofeyev - "Measurement of the Gas Density During the Dynamic Operation of a Discharge" (see p 1306 of the journal). A.V. Nedospasov - The Nature of a Striated Positive Column".

V.L. Fakel' and Yu.M. Kagan - "The Theory of Probes for Arbitrary Pressures".

Yu.M. Kagan et al. - "The Positive Column of a Discharge in a Diffusion Regime".

M.V. Konyukov - "Influence of the Processes of the Annihilation of the Negative Ions on Their Concentration in the Column".

M.D. Gabovich and L.L. Pasechnik - "Anomalous Scattering, Excitation of Plasma Oscillations and Plasma Resonance"

Yu.L. Klimontovich - "Energy Lost by Charged Particles for the Excitation of the Oscillations in Plasma (the Langmuir paradox)" and "The Theory of Non-linear Plasma Oscillations".

Ye.G. Martinkov and I.G. Nekrashevich - "Dependence of the Temperature in the Near-electrode Region of a Pulse Discharge on the Material of the Electrodes".

N.A. Neretina and B.N. Klyarfel'd - "Formation of Light Spots on the Anode of a Gas Discharge (see p 1301 of the journal).

N.A. Matveyeva -"Distribution of Binary Mixtures of Inert Gases in a d.c. Discharge".

V.G. Stepanov and V.F. Zakharchenko - "Some Phenomena in Rarified Plasma".

V.G. Stepanov and V.S. Bezel' - "The Possibility of Obtaining Highly Concentrated Plasmas".

G.V. Smirnitskaya and E.M. Reykhrudel' - "Some Characteristics of the Discharge in an Ion Pump and in a Magnetic Ionisation Vacuum Gauge".

Ye.T. Kucharenko and O.K. Nazarenko - "Properties of a Discharge with Electron Oscillations in a Magnetic Field" (see p 1253 of the journal).

The paper by L.M. Biberman and B.A. Veklenko considered the approximate methods for determining the concentration of atoms at the radiation levels.

I.I. Sobel'man and L.A. Vaynshteyn read a paper on "A Non-stationary Theory of the Stark Broadening of the Spectral Lines in Plasma".

N.A. Masing and S.L. Mandel'shtam - "The Broadening and the Shift of Spectral Lines in a Gas-discharge Plasma".

[illegible] (England) - "The Kinetics of Electron Collisions Leading to the Excitation of the Molecular Hydrogen in a Hydrogen Discharge".

V.I. Kolesnikov et al. - "Some Properties of the Arc Discharge in an Atmosphere of Inert Gases".

A.A. Mak and M.E. Kanyukov - "Production of High Temperatures By Means of Spark Discharges". 1/7

NEKRETINA, N.A.; KLYARFEL'D, B.N.

Anode region in gaseous discharges at low pressures. Part 2: Effect of the temperature of plasma electrons, the temperature of the anode surface, and the accomodation coefficient of molecules on the anode. Zhur.tekh.fiz. 29 no.1:15-23 Ja '59. (MIRA 12:4)

1. Vsesoyuznyy elektrotekhnicheskiy institut im. V.I. Lenina, Moskva.

(Gases, Ionized)

9.3150,24.2120

77312
SOV/57-30-2-9/18

AUTHORS: Klyarfel'd, B. N., and Neretina, N. A.

TITLE: The Anode Region in Low Pressure Gaseous Discharge. Part III. The Appearance of Supplementary Plasmas on the Anode (Anode Spots) ((I) ZhTF, XXVIII, 296, 1958; (II) ZhTF, XXIX, 15, 1959)

PERIODICAL: Zhurnal tekhnicheskoy fiziki, 1960, Vol 30, Nr 2, pp 186-198 (USSR)

ABSTRACT: For a positive anode voltage drop, the film of the discharge glow covers usually the anode uniformly. However, when the pressure exceeds a value characteristic for a given gas and the anode current density is kept above 10^{-3} to 10^{-2} a/cm^2, a bright hemispherical spot is formed over the background of the anode glow. With the further increase of pressure there is an increase in number of spots and their relative brightness while the radius of a single spot decreases. For particular values of pressure and current many sharply outlined

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spots cover the anode with regular patterns. At still higher pressures these spots disappear again. The authors review various explanations for the appearance of these spots given by researchers during last 35 years and conclude that the final answer about the nature of these spots is still far away. In the present paper they present investigations in vapors of mercury, in inert gases, and in hydrogen. Introducing probes into the spots from the anode side they managed to investigate directly the properties of spots. The regular patterns of spots were explained by the inverse influence of each spot on the discharge region surrounding it. To investigate the conditions for occurrence of spots the authors performed tests on Hg vapor for various values of pressure p, anode voltage drop U_a, current i, and the temperature of the anode T_a. Results are on Fig. 1. Single line curves are obtained in absence of spots; the double line with one spot present. The relationship between the pressure and the number of spots was found using hydrogen discharge which produces many and stable spots. Results are on Fig. 2.

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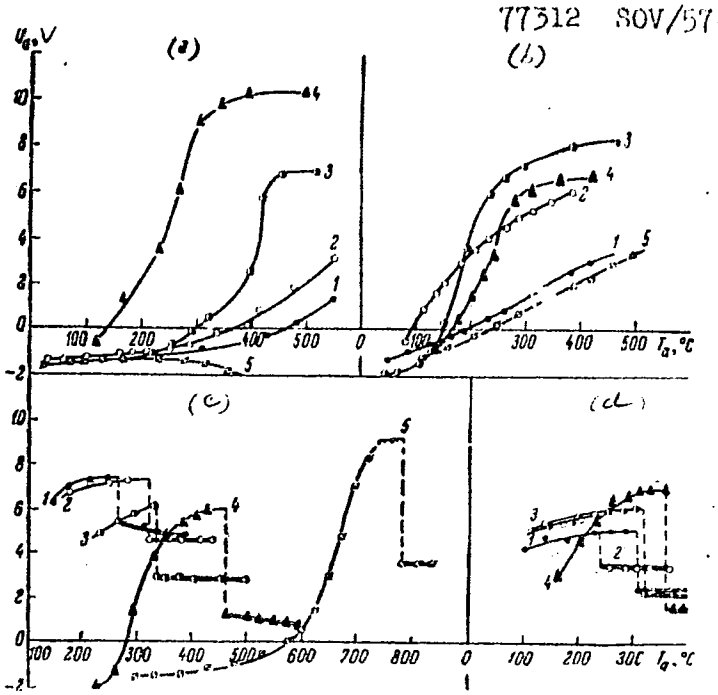

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Fig. 1. Occurrence of spots for various values of i, p, T_a, and U_a. (a) p = 0.001 mm Hg; (b) p = 0.003; (c) p = 0.01; (d) p = 0.08 mm Hg. Values of the discharge current: (1) 0.1a; (2) 0.3 a; (3) 1 a; (4) 3 a; (5) 10 a.

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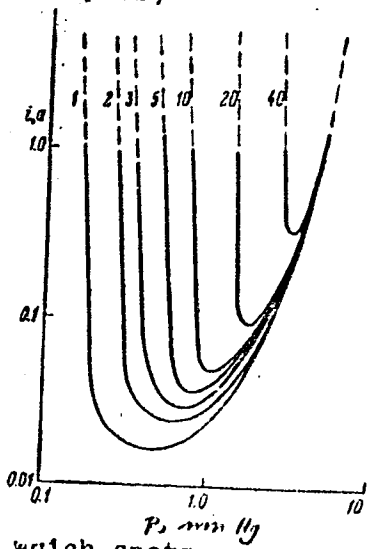
Fig. 2. The relationship between the number of spots and i and p in hydrogen. Number of spots is indicated next to each curve.



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The pressure regions in which spots can exist are different for different gases. The authors found

that the current density on the anode decreases from the center toward outer boundary. The current density on a spot is at most twice as strong as one the rest of the anode. To investigate the spots themselves, the authors used an anode arrangement as on Fig. 4. A_1 is the basic anode; A_2 - its central region with separate connection; S_1 - probe made of tungsten wire 0.1 mm in diameter, with a 0.4 mm sphere at its end, 1.5 mm in front of A_2. S_2 was inside the positive column and served to determine the anode voltage drop. Table A contains t the results obtained. i_1 and i_2 are currents on A_1 and A_2, respectively. u_1 is the potential drop between S_2 and the spot u_2 between the spot and A_2. Δu is the potential difference between A_2 and A_1

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Fig. 4. Discharge tube for probe measurements inside the anode spot.

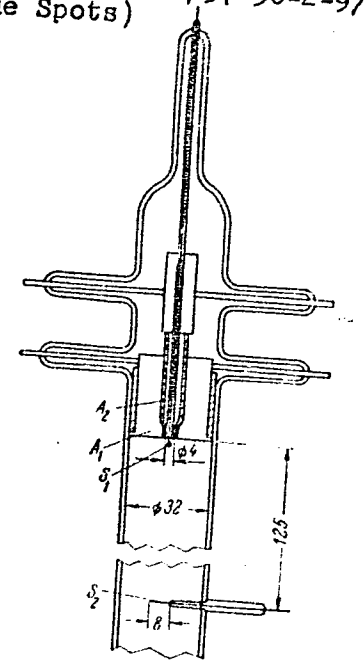

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Table A. Discharge in Mercury Vapors. Anode Diameter 32 mm; Diameter of its Central Part 4 mm.

№	P, mmHg	i_{a_1}, a	i_{a_2}, a	U_{a_1}, v	U_{a_2}, v	ΔU_a, v	T_e', °K	T_e, °K	T_e'/T_e
	1	2	3	4	5	6	7	8	
1	0.003	2	0.100	+11.3	−3.5	3	63,000	20,500	3.1
2	0.003	0.5	0.035	+13.7	−3.0	7	76,000	27,000	2.8
3	0.006	0	0.100	+20	−2.0	—	72,000	20,100	3.6

necessary to keep the spot on A_2. T_e' and T_e are electron temperatures in the spot and column, respectively. The authors note the relative constancy of the T_e'/T_e ratio. In connection with these temperatures the authors discovered the cause of large influence of the spots on the general

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discharge. To calculate K, the average ionization rate per electron, they developed an equation

$$\alpha = ABp_0\left(\frac{8e}{\pi m_e}\right)^{1/8} U^{1/8} e^{-\frac{U_i}{U}}\left[\frac{U}{(1+BU)^2}+\frac{U+U_i}{1+BU}\right] \qquad (2)$$

using approximation for the effective ionization curves given by Klyarfel'd (J. of Phys. USSR, 5, 155, 1941). Here $U = \frac{kTe}{e}$, and substituting the temperature values one finds that K in the spot is 50 times larger than the K in the positive column. This was verified experimentally by discovering that 10% of the total current originating on A_2 (and the spot) was sufficient to destroy completely the positive anode potential drop due to the large ion production inside the spot. In addition, the authors concluded after performing appropriate tests that the degasing of the anode, the the electron reflection from the anode, and the decrease of inelastic energy losses with an increase of pressure

cannot be the decisive factors for the occurrence of the spots. On the basis of all the above they propose the following mechanism: An initial large anode voltage drop and sufficiently high gas pressure are the simultaneous necessary conditions for a large density of positive ion generation. When this ion generation reaches some critical value, a new plasma starts to develop in the form of a thin uniform layer whose potential exceeds that of the anode for a few volts. This state is, nevertheless, unstable, and a small nonuniformity in ion leads to a process exemplified on Fig. 7. The authors further investigate the influence of single spots on their surroundings and the condition allowing the simultaneous existence of many spots. With an increase in pressure the radius of action of single spots decreases, allowing creation of new spots with identical properties with respect to the discharge and, therefore, spaced in a regular pattern. Still higher pressure reduces the size and thickness of the spots to the thickness

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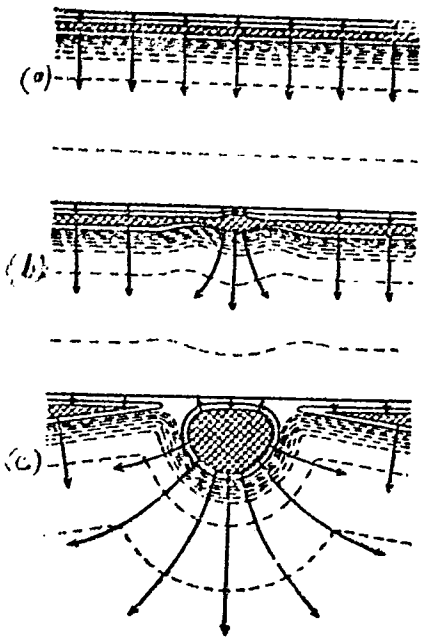
Fig. 7. Spot formation on the anode. Full lines indicate equipotentials at a potential higher than that of the anode; dashed lines indicate equipotentials at a potential lower than that on the anode.



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of the anode glow until they finally disappear. The authors gave also a detailed analysis of processes happening between electrodes and the plasma in three basic situations: (I) when the electrode is more negative than the plasma, (II) when the electrode is more positive than the plasma, and (III) when around the electrode is formed a supplementary plasma (spot). They point out that often the discharge represents a self-oscillating system, and periodic transitions of electrodes, or parts of electrodes, from one basic situation to another leads to a generation of low frequency potential oscillations. The final discussions were based on data from the literature as well as on data obtained by the authors. There are 7 figures; 1 table: and 18 references, 11 Soviet, 3 German, 4 U.S. The U.S. references are: E. Sternglass, Phys. Rev., 95, 345, 1945; S. Rubens, a. J. Henderson, Phys. Rev., 58, 446, 1940; C. Thomas, a. O. Duffendack, Phys. Rev.,

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35, 72, 1939; J. Langmuir, a. H. Mott-Smith, Gen. El. Rev., 27, 767, 1924.

ASSOCIATION: All-Union Electrotechnical Institute, Moscow (Vsesoyuznyy elektrotekhnicheskiy institut, Moskva)

SUBMITTED: January 19, 1959

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